Force XXI Technology and the Cognitive Approach to the Military Decision Making Process (MDMP)

A Monograph
By

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Force XXI Technology and the Cognitive Approach to the Military Decision Making Process (MDMP) by Michael C. Sevcik, US Army, 43 pages.

The United States Army has invested millions of dollars and countless man hours in information technology. This investment in technology is a result of digital capabilities unimagined several years ago. It stands to reason, if better information is available faster, that better decisions will follow. The key to better decision making through digitization lies in situational awareness based on informational awareness. This knowledge will contribute to certainty and a temporal advantage over the enemy. Digital technology and the Force XXI (FXXI) efforts have tremendous potential to support decision making. Digital technology however, poses some daunting dilemmas for the Army. With the tremendous technological advantages come tradeoffs that may hinder a commander more than information awareness assists him.

Information technology holds the key to improving the MDMP. However, exploitation of digitization requires a reexamination of the Army's decision-making concepts. The rational decision making model has organized the Army's staffs and guided collection of data in support of deliberate planning. The advent of instantaneous information through digitization permits the commander to receive data and information directly and this enables him to adjust his plans during an operation. This instantaneous information permits the commander to revise his intent and adjust plans to conform to the needs of the operations and take advantage of opportunities. Plans, therefore, can emerge from the commander's assessment of the situation and he can focus on information needed to support his decisions.

Staff efforts historically focused on collection of data to support the MDMP. The staff in turn produced a plan and monitored the operation providing feedback to the commander. The decision process was formal and largely left out how the commander made decisions. However, with digitization, how the commander makes decisions, defines what he must "see" on the battlefield. This vision is the relevant common picture (RCP). If the commander uses his experience to see patterns, then he must be able to communicate his intended changes to the formal plan to take advantage of opportunities. The plan emerges from this interaction. The commander's staff may need to be organized around the needs of emergent plans rather than those of formal plans. Thus, a new staff organization is envisioned for the future.

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No plan ever survived the first shot of battle.[1]

Introduction

The United States Army has invested millions of dollars and countless man hours to infuse information technology into military operations in the hopes that technology will provide a military advantage. The infusion of technology into the warfighters decision-making process is complicated and tedious. Reducing uncertainty is the most promising advantage information technology brings to the warfighter. Specifically, improving the military decision-making process (MDMP) can reduce uncertainty and contribute to successful military operations.

The complex issues of command & control, leadership, timing, and human factors influence military operations. Martin Van Creveld, in *Command in War*, presented a blueprint for an ideal command system:

> "An ideal command system should be able to gather information accurately, continuously, comprehensively, selectively and fast. Reliable means must be developed to distinguish the true from the false, the relevant from the irrelevant, the material from the immaterial. Displays must be clear, detailed and comprehensive."[2]

Effective decision making at all levels depends on these factors. Because war is the violent clash of two opponent's wills, decision making must take into account the enemy. As a friendly commander attempts to impose his will on the enemy, the enemy tries to impose his will on him. A military commander does not make decisions exclusively based on numbers and weighing values for different courses of action. The commander uses his initiative and experience to make effective decisions. The commander, who can make good decisions faster than his adversary, gains an advantage. Finally, since uncertainty exists in all decision-making

conditions, there is no perfect solution to a problem. A solution, which offers a reasonable degree of success, is often the best decision, if executed before the enemy can prepare.

The Military Decision Making Process (MDMP) is neither difficult nor complicated. Reducing uncertainty during combat operations is very difficult. Applying information technology and automating the MDMP likewise is proving to be a difficult and complicated process demanding a lot of time, money and effort. Noted military historian MartinVan Creveld offers some insight for improving decision making.

> Confronted with a task and having less information available than is needed to perform that task, an organization may react in either two ways. One is to increase its information processing capacity, the other to design the organization and indeed the task itself, in such a way as to enable it to operate on the basis of less information. These approaches are exhaustive; no others are conceivable. A failure to adopt one or the other will automatically result in a drop in the level of performance.[3]

Van Creveld notes that when making decisions under uncertainty there are only two approaches for improvement. Redesigning the Army's organization and organizational tasks, though a necessary aspect of automation, are beyond the scope of this monograph. However, automation clearly increases the quantity and quality of information and simultaneously demands efforts to improve analysis of the data. The Army's digital effort is directed towards the improvement of both quantity and quality of information.

There are several methods for improving the information processing capacity. The first approach is to establish better criteria for selection. The second is to develop a plan, which is inherently flexible that allows for decisions and adaptation as a military operation progresses. Adaptive planning systems formulate decisions based on time, terrain or enemy action. Finally, rapid and accurate information enhances the commander's decision making. Reducing

uncertainty and speeding decision making by applying technology to enhance the MDMP are the centerpiece of this monograph.

Despite technological improvements only imagined several years ago, there remains one constant in war: "Man is the fundamental instrument in battle."[4]

> So wrote Ardant Du Picq in his 1868 "Battle Studies." His words echo the conclusions of Sun Tzu (500 BC), Vegitius (400 AD), De Saxe (1750), Fredrick (1753), Napoleon (1800) and Clausewitz (1830) and others. There is every reason to believe that not only will this statement remain true, but also the performance of men and military organizations will make an even greater proportional contribution in the future. The future battlefield will be a less forgiving crucible, and relative advantages in leadership, teamwork, competence, creativity, commitment, and steadfastness will play a greater role in deciding who wins and who loses with what losses. [5]

The fundamental nature of man does not change. Digital decision-making systems should be designed to take advantage of human strengths. Likewise, digitally designed systems should help offset human weaknesses. The commander, not information technology, exploits the enemy, controls the tempo of operations and shapes the battlefield to defeat an enemy. As part of the FXXI experimentation process, the Army must view progress through the eyes of the commander. The question for the Army to answer is whether its FXXI information systems support the cognitive requirements of 21st Century tactical decision making.

Unlike business organizations, the United States Army does not buy new technology. The Army applies technological advances to create a military system consistent with changes in doctrine, training, leader development, organization, materiel and soldier systems. A military innovation begins with a cognitive change in the way the Army approaches military operations. The Army's FXXI effort represents an attempt to integrate information technology to improve the quality of the MDMP.

An essential component of the FXXI concept is battle command. One aspect of FXXI battle command is its focus on command as a process that uses information to make better decisions. Assessment of the Army's effort to integrate information technology to support the MDMP largely entails investigation of the digital innovations in information collection and display. The Army Battle Command System (ABCS) and its Maneuver Control System (MCS) components are the primary systems supporting decision making in FXXI. This study will present an overview of the MDMP with applications from business and academia. It provides examples of successful applications that support the cognitive requirements of the commander and will illustrate shortfalls. With conclusions drawn from this analysis, the essay points out promising improvements to the MDMP and illustrates shortfalls resulting from an uncritical adoption of information technology. The monograph concludes with recommendations for implementing solutions to correct shortfalls and retain the successful applications.

Chapter 1, Change, FXXI Technology and Situational Awareness

In March of 1994, Army Chief of Staff, General Gordon R. Sullivan and United States Army Training and Doctrine Command (TRADOC) Commander, General Frederick M. Franks, Jr., started the FXXI process. The Army was thus committed to change, in order to adopt the FXXI technological innovations. [6] The Army created *Joint Venture* (JV) to manage the FXXI process of change and to lead the Army into the 21st Century. JV is a partnership between Forces Command (FORSCOM), Army Material Command (AMC) and TRADOC. The three major organizations work together to investigate the changes needed to exploit innovative technologies. The Generals Sullivan and Franks document was visionary, despite its failure to address the technical details of the transformation. The TRADOC Commander used a series of seminars to explain the technical aspects of FXXI to the warfighters. The seminars translated the technical specifications found in the JV memo into common military terms and defined the Joint Venture goals as *patterns of operation.*[7]

The patterns of operations serve as the Army's blueprint for developing information technology. The patterns of operation adopted by TRADOC are to:

- Project the Force
- Protect the Force
- Gain Information Superiority
- Shape the Battlespace
- Conduct Decisive Operations
- Sustain/transition the Force

A change in any one pattern will result in a change to one or several other patterns. Consequently, changes in information technology within each pattern must be measured by the overall success of the system. The key to FXXI information dominance is the systematic

infusion of technology into these patterns of operation. The challenge is to change the Army across the DTLOMS (doctrine, training, leader development, organizations, materiel and soldier systems) to improve the effectiveness of maneuver, firepower, protection and leadership.[8]

At the center of the Joint Venture process is the *Advanced Warfighting Experiment (AWE)*. The AWE is a series of exercises during which the DTLOMS innovations come together in a simulated warfighting environment. In March 1997, the 4th Infantry Division's 1st Brigade (*Raider)* Combat Team conducted the Task Force AWE at the National Training Center at Fort Irwin, California. Later, in November of 1997 the 4th Infantry Division (Mech) was reorganized, at least conceptually, and conducted the simulated Division AWE at Fort Hood, Texas.[9] For the Army, the JV process produced two significant results that influenced further experimentation, spiral development and a firm schedule.

First, spiral development is a term used to describe a collaborative process by which the user, developer, and testing community sit side-by-side and collectively create a military innovation that meets an operational need.[10] Spiral development includes procedures intended to capture lessons quickly and to build upon previous lessons. Spiral development is a risky process that can accelerate the acquisition of a valuable product. Spiral development can also be exploited by unscrupulous contractors and materiel developers to circumventing congressional mandates, United States Code, Department of Defense and service acquisition regulations. Two important factors point to a need for rapid acquisition process (RAP). The bureaucratic challenges existing within federal law and DoD 5000 series guidance. Additionally, the life cycle of technology, particularly software systems, is growing shorter. With a ten-year material acquisition process and a software life-cycle of two years, the problem is obvious. The

long acquisition process does not permit the timely acquisition of military hardware, particularly software systems.

The second result of the JV process forced the different organizations involved in FXXI process to adhere to a firm schedule. The AWE represented a deadline on the calendar. The AWE suspense dates ensured the contractors, developers, doctrine writers, soldiers and leaders all worked together to fulfill their responsibilities.[11] Meeting the schedule was so important that the parties involved had to be forced into compliance. There is always the temptation in a large project to add another good idea that will just take a few more days to get the software or training straight. In the 4th ID during the TF AWE the Brigade Combat Team Commander (then Colonel Tom Goedkoop) had the authority to decide which innovation was accepted. If the new system was not ready in time to train, install and test, it was eliminated from the TF AWE. In preparation for the TF AWE, the 4th ID established a digitization factory that installed some 5000 new items of equipment on existing platforms and vehicles. The factory operated continuously for 205 days and nights before the TF AWE.[12] The TF AWE worked well at Fort Hood, but the Army still needed coordination of the FXXI process at higher levels. The Army Digitization Office (ADO) synchronizes the FXXI efforts for the Army.

As the Army develops new information technologies, it must synchronize and integrate requirements as well as program force structure and funding. These tasks are critical to ensure the First Digitized Division (FDD) is equipped by the end of FY 00.[13] The ADO responds to the Army's Deputy Chief of Staff for Operations (DCSOPS). ADO works in close coordination with TRADOC, the Program Executive Office, Army Materiel Command, Testing Agencies (OPTEC/TECOM) and FORSCOM. The ADO's mission is to provide a trained

and ready force for Army FXXI that exploits information dominance can operate in joint and coalition operations and is capable of achieving full spectrum dominance.[14] To this end, the Army is developing many new technological initiatives. The most important program in the effort to exploit information dominance (ID) is the Army Battle Command System (ABCS).

Army Battle Command System

Information operations seek to support and enhance the elements of combat power. Successful information operations permit the commander to dominate the battlespace at the right time, at the right place and with the right weapons or resources.[15] The ABCS is a system and process that integrates the information efforts of essential organizations to achieve information dominance. ABCS enables warfighters to operate more effectively by reducing uncertainty in four areas:

> Where am I?
> Where are friendly elements?
> Where are enemy elements?
> What is the status and activity of each element? [16]

Commanders have always had difficulty knowing the accurate battlefield situation. The FXXI process tries to improve the information available and thereby, lessen uncertainty. While war is intrinsically unpredictable, the FXXI process can assist military judgment by providing answers to the ABCS questions.

By providing information about the friendly and enemy situation, the ABCS improves decision making and planning and reduces the Commander's uncertainty. The ABCS accomplishes this by (1) reporting information in real time or near real time; (2) providing information in a user-friendly format and (3) presenting information in a manageable format.[17]

The ABCS is designed for vertical and horizontal integration throughout the force. It is vertical in the traditional sense of a hierarchical military organizational structure. It is horizontal because it allows numerous subordinate units and their staffs to share a common battlefield view. The shared information from ABCS empowers leaders, reduces crew workload and contributes to automated command and control (C2). The ABCS decreases decision-making time and enables warfighters to operate inside the enemy commander's decision-making cycle. Therefore, commanders use ABCS to synchronize combat operations, concentrate force effects and prevent fratricide to dominate the battlespace.[18]

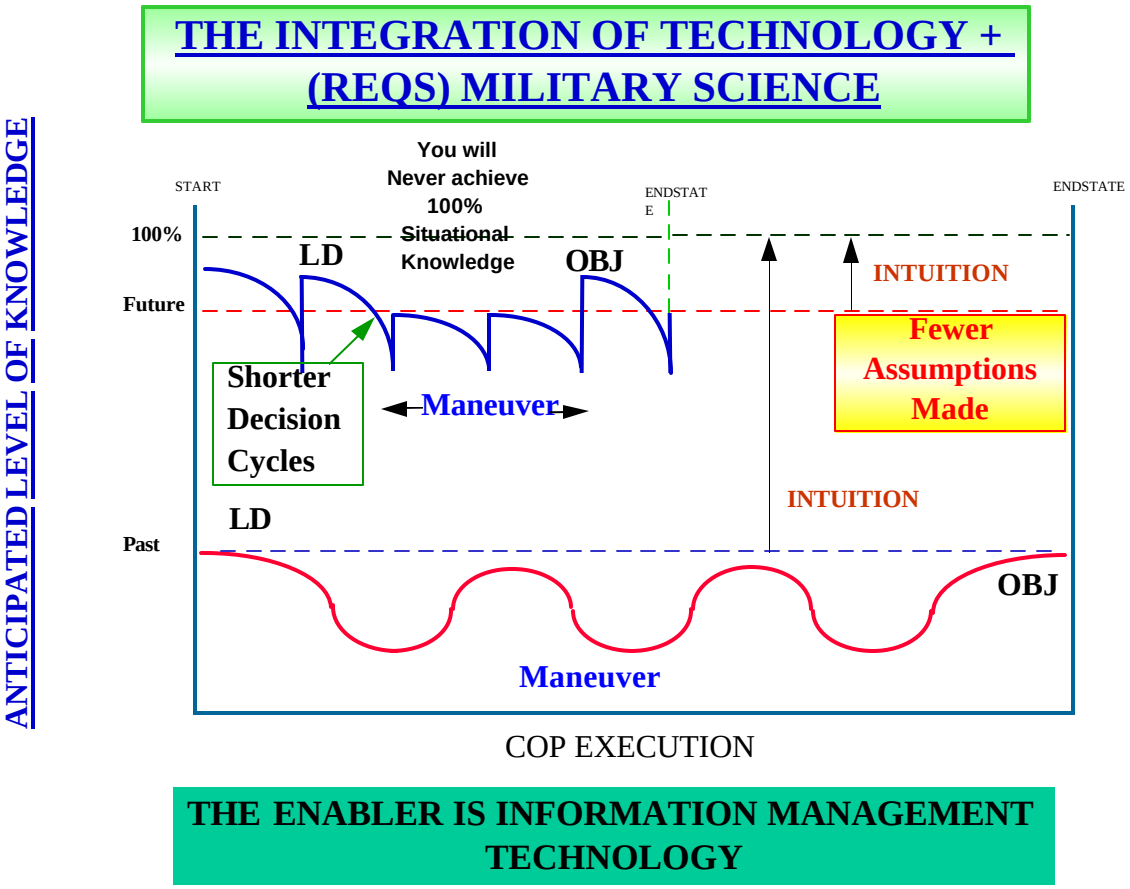
The United States Army's FXXI digitization efforts are designed around the premise that timely information will enhance situational awareness will decrease decision-making time and result in increased lethality, survivability and operational tempo. The Secretary of the Army explained this premise in his posture statement to the United States Senate in 1995.[19]

Digitization (Definition)

The application of information technologies to acquire, exchange, and employ timely battlefield information. It will enhance situational awareness and provide the means for information dominance by enabling friendly forces (10 Divisions, RC, and Joint / Combined) to share a common picture of the battlefield while communicating and targeting in real or near real-time. Digitization will reduce the "fog of war" and decrease decision-making time by optimizing the flow of information. It will allow the "orchestration" of combat power at critical times and places faster than an adversary can. It will contribute to increased lethality, survivability, and operational tempo while reducing the potential for fratricide…..to ensure seamless digital communications from the sustaining base to the tactical and strategic levels.

SECARMY, Togo West & GEN Reimer (Posture Statement, US Senate)

Accurate and timely information reduces uncertainty. To win on the battlefield, commanders must exploit every advantage they possess over the enemy to achieve victory. Perhaps the most valuable advantage is time. The commander should exploit every opportunity to save time. While situational awareness is never 100 percent, it can shorten decision cycles. The slide below illustrates this concept.[20]



This chart describes the integration of technology into the MDMP and indicates that shorter decision cycles lead to better situational awareness. The x-axis across the bottom of the chart represents the Common Operating Picture (COP) over time. The COP represents information about terrain, enemy and friendly forces available to a commander and/or his staff. The vertical axis represents the anticipated level of knowledge available to a commander during the operation. The vertical axis indicates that in the past as an organization left the line of departure, the commander's anticipated level of knowledge had large decision cycles. The large decision cycles over time result from slow and inferior information about terrain, friendly and enemy forces. Before radio technology, the decision cycle might be hours or even days as

commanders waited for messengers on foot or horseback to report the battle. Higher on the vertical axis is the future timeline that indicates shorter decision cycles perhaps representing minutes or seconds. The shorter decision cycles and the rapid spike of information on the top of the chart represents greater situational awareness for the commander over time. Shorter decision cycles are key to getting inside the enemy's decision cycle. The right hand side of the COP execution chart indicates that in the past commanders made decision with greater reliance on intuition. Because of information technology and greater situational awareness, the commander in the future will need to make fewer assumptions. He will be less dependent on intuition and have greater access to real time information.

An essential aspect of the Army's digital efforts to improve decision making is the common operating picture. The ABCS provides efficient management of information through the common operating picture. ABCS contributes to the COP by distributing tactical orders and reports digitally, allowing commanders to receive, analyze and transmit critical battlefield information. ABCS assists the commander to apply combat power at the right time and place in response to a changing battlefield situation. It provides ready access to current situation reports (friendly), intelligence and contact reports (enemy) and terrain.

FXXI Technology and the MDMP

The ABCS initiatives work together to provide situational awareness and a relevant common picture (RCP). The Maneuver Control System, which is part of the ABCS, is designed to aid decision making and speed preparation of operations orders. The MCS is an integrated system of computer hardware, software, personnel and procedures. The MCS is designed as a set of tailorable applications and helps provide commanders at different levels, a

common operation environment (COE). MCS accomplishes this through the automated distribution of tactical reports and orders. This allows the commander to rapidly receive and apply critical battlefield information. MCS contains features and tools that allow the addition of specific staff-officer oriented applications such as the Operations Orders (OPORD) and Maps and Overlays modules. The MCS applications are both unique and common. The unique applications are those applications that support a particular Battlefield Functional Area (BFA) domain. The BFA concept is common in the Army and indicates the maneuver, logistics, intelligence, ADA, C2, and fire support domains. The common applications for MCS are those shared by two or more BFAs. The core set of MCS software consists of the numerous applications (common and unique) listed in the Block III, Block IV and common tactical picture segments in Appendix 1.[21] The MCS is the only ABCS sub-system that has interface with the Army's MDMP. To determine if the FXXI information systems support the commander's warfighting needs, the decision-making aspects of MCS must be understood

Maneuver Control System

In 1994, the MCS Operational and Organizational (O&O) Plan called for the MCS to accomplish several functions which support the commander's decision-making needs. These functions include developing decision aids for the employment and sustainment of combat power. Next, the ability to direct subordinate and supporting units on the battlefield is an important aspect of C2. Additionally, coordinating among maneuver units by means of digital messaging and monitoring their operations was a critical capability. Finally, responding to CCIR requirements of the Commander is also an important requirement for the Maneuver Control

System. [22] From the beginning, the MCS designers planned for the system to be a decision-making tool and to help commanders control operations.

The early O&O plan evolved as time passed and the MCS acquisition strategy that emerged was different than originally intended. As digital capabilities improved, the needs of the commander took on more importance. This emergent strategy was not planned, but resulted from the extensive testing and participation by operational units. Operational units played a role in every aspect of the testing, development and evaluation of the MCS. Current MCS capabilities are annotated as block III, while future capabilities are block IV.

The current block III MCS digitally updates friendly and enemy unit information and provides information about terrain and geometry. The MCS includes a tactical overlay, editing function and a 3-dimensional-flight viewer that enables commanders to digitally send updates across the battlefield. The MCS provides the commander with operations planning and orders capability using MS Word templates that link the unit tasking order to the OPLAN products. MCS is digitally linked to the other ABCS systems and provides logistical updates, graphic or tabular display of logistical resources and combat strength. The synchronization matrix capability of the MCS graphically displays unit missions as they relate in time. COA analysis comparison is also an MCS capability. The messaging capabilities of MCS include auto forwarding and auto sending of all MCS data. The C2 products include an interactive whiteboard-planning tool for war-gaming OPLANs, archive and filing systems as well as access to other utilities.

Block IV, future MCS capabilities plan to increase the transfer of database information and the integration of planning capabilities into real-time maps and reports. Block IV also includes plans for use of a Joint Mapping Toolkit providing service interoperability as well as mapping functions integrated with OPLAN/OPORD and execution matrix. Additionally, block IV provides improved graphic views of unit organizations, capability to modify and adapt command relationships and automated capabilities to transfer unit task orders to other MCS users. The future capabilities MCS point not just to improved automation, they represent capabilities that will enhance decision making and planning for the commander on future battlefields. The ability to adapt a plan during military operations is an important capability of MCS.

Another aspect of the ABCS concept is flexibility. Tailorable MCS applications give commanders flexibility. Automatic forwarding and automated information collation enhances flexibility. Authorized users, within the network, receive information from distributed sources; locally and remotely implemented though a seamless C2 client/server architecture.[23] This flexibility coupled with the MDMP capabilities help the commander apply combat power to the right place and time in response to a thinking and adaptive enemy. The accurate and rapid exchange of information gives command posts from battalion through corps the same common operating picture of the battlespace. The commander's decision making, therefore, is synchronized with other commanders in the network.

Commanders using the ABCS have better, timely and accurate enemy and friendly information. The COP provides a view of the battlefield that before was unattainable; this represents a breakthrough for decision making. The COP, when combined with good Standard

Operating Procedures (SOP), will enable the battlestaff to conduct both anticipatory and adaptive planning because commanders at all levels have the same information about the operation. As opportunities emerge during operations, commanders can rapidly change plans and redirect units to take advantage of speed and surprise. The automated procedures aid the adaptive planning process and contribute to seizing the initiative. Commanders share information, both vertically and horizontally, to help make sense of the battlefield. Horizontal information technology normally enhances centralized control. With centralized control, there are some shortfalls.

Central or Decentralized Control

Current Army doctrine emphasizes battle command as the doctrinal concept which links information technology with how the Army intends to conduct operations. Battle command and battlefield visualization are uniquely human endeavors. While ABCS and technology can assist, human decision makers still direct battlefield operations. It is impossible to fully visualize the battlefield and command units from an MCS display in a battalion Tactical Operations Center (TOC). Commanders must frequently visit subordinate commanders and soldiers to assess the battle.[24]

An unintended consequence of the FXXI Technology will be the tendency for commanders to return to centralized command and control. This is not a new phenomenon. In Vietnam, brigade commanders in the early 1970's, often controlled squads and rifle teams from the air. Because of technology in the 1970's, it was possible to bypass the command and control structure. In the digitized world of warfighting, large quantities of information will be

available to commanders and so will the tendency to overcontrol. Leaders must avoid the temptations of centralized control.

Information Technology alone will not reduce the decision cycle. Although information in a visual format is easy to understand, it is not always easy to believe. ABCS technology has increased the volume of information, accelerated OPTEMPO, extended battlespace and invited unknowns that will accompany the digital change. Digital technology may increase *fog of war* if the man-machine interface is not correctly designed. Soldiers must receive adequate training in information technology. If not, the time spent sorting through the endless data in search of information will be time wasted. An enemy can use wasted time as a weapon.

Design for Adaptive Decision Making

Several years ago, the Army Maintenance Management System was digitized. Since WWII, the DA form 2404 has been the manual maintenance form for recording deficiencies on equipment and vehicles. The design for the new automated form was an identical copy of the manual 2404 form, but the new form was assigned a new number, DA Form 5988e. The difference is a digital likeness displayed on the computer monitor. There was no systematic development of an automated maintenance management system that leveraged the power of automation. The approach was a quick way to automate, but the solution did not provide any advantage. In retrospect, a better plan would have been to tie the data on the form to the elements of the maintenance system. One automated system could accomplish parts ordering, technical inspections and inventory control. This same caution applies to development of the ABCS and the FXXI program. Design of the FXXI system with the human commander and his decision-making needs must guide the acquisition process. As the Army weighs deeper into

digitization and information technology, care should be exercised to resist technology with little benefit. It will be important to link the acquisition community to the combat developers (TRADOC), materiel developers (PEOs & AMC),and testers (OPTEC and TECOM). Each activity must be aware of the digital systems affect upon the DTLOMS to build synergy. If the Army fails in this, the result will build allergy.[1] [25] The Army focus must encompass more than just the software, hardware and materiel acquisition. Doctrine, training, leadership, organization, manpower and soldiers systems (DTLOMS) areas must all be included to build an innovative system.

The failure to consider some aspects of DTLOMS contributed to some operational failures at the TF Advanced Warfighting Experiment in 1997. While the digitized division and digitized Brigade Combat Team demonstrated the promise of technology, they were consistently defeated at the NTC by the OPFOR during the Task Force AWE.

> "…The speed of the battle seemed to be dictated by the OPFOR. The high level of training present in the OPFOR and thorough knowledge of the terrain effectively negated the *digitized* brigades' advantages, inherent in the situational awareness provided by appliqué (Italics added).[26]

The digitization of a force does not necessarily mean that the force will operate with certainty; nor does it mean the force will operate within the decision cycle of the enemy. The TFXXI AWE showed the exact opposite could happen. Digitization is a panacea; the TFAWE showed that a well-trained unit performs well against a less trained digital opponent

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Note: Taken from Mintzberg page 45, effects of synergy can be negative which Loasby labeled "allergy." In discussing the creation of strategy Mintzberg noted (page 303) that it cannot be programmed like shoveling coal. Taylor's engineers cannot put the steps back together into an efficient job...Nor can capital budgeters whose process proved not only disjointed by disjointing, an explicit deterrent to synergy. (How ironic that synergy should be impeded by the very planning procedures popularized.)

During the Task Force AWE, the 404th Support Battalion deployed to the National Training Center. Because of their late entry into the rotation, the initial ABCS distribution did not include the battalion. The Internet Protocol (IP) addressing of the tactical information net had left the battalion out of the experiment. After much thought and discussion by the 4th Infantry Division leadership, the battalion received five appliqué (earlier generation of FBCB2) systems and one MCS computer system. The 404th Support Battalion commander had to decide how to distribute the five appliqué computer systems. The Support Operations van received one applique system and the battalion vehicles received the other four systems. Although no one in the unit realized it, the distribution plan enhanced the battalion's ability to conduct adaptive decision making. The support battalion mission is to arm, fuel, fix, move and sustain the Aviation units. The battalion's mission involves mobile maintenance contact teams, logistics convoys and establishing forward area rearm/refuel points (FARRP). Distribution of the applique systems ensured they would provide the best pay-off, based on the mission.

The 404th battalion's Class III/V (fuel and ammo) Platoon Leader provides an example[27] of the value of information technology. Equipped with an appliqué system, a lieutenant often deployed his small FARRP forward in support of the aviation brigade's reconnaissance efforts during night operations. The platoon deployed and selected a FARRP site. Once established, the platoon leader drew a sketch of the new site. With GPS as an integral part of his Appliqué system, driving to the points and noting the ten digit grids for all the points completed the sketch. Plotting obstacles, hazards, wind direction and other critical aviation related information was easy. Digitally sending the information back to the battalion was a simple task. The battalion support operations officer (SPO) ensured the report's

accuracy and digitally forwarded the information to the Aviation Brigade operations section and pilots. The sketch was as easy as sending e-mail to multiple users. Every mission aircraft had a digital copy of the new FARRP schematic with safety, obstacles and details giving them everything needed to be successful, before they launched the mission. This critical information was transferred at the speed of light. Normally, it would take hours to deliver the sketch, and it would be incomplete if transmitted by voice.

The correct mix of digital equipment was another reason for the battalion's success. More is not always better. While the six other battalions participating in the TF AWE were busy training soldiers and installing hundreds of ABCS systems, the 404th Support Battalion had to install just five Applique systems. The battalion commander hand-picked 20 soldiers to train with ABCS technology. This allowed the rest of the battalion to concentrate on training for their core missions. Most other units became so overwhelmed with the installation of new equipment, training and other missions, they lost some of their training competencies.

The soldiers participating in the TF AWE lacked some traditional warfighting skills because training time was devoted to digital training and installation requirements. These weak warfighting skills contributed to the TF failure. The Army has also accepted over-digitization. Just as there are too many FBCB2 systems distributed across the division, not every soldier in an Infantry Battalion needs a dismounted soldier system (DSS). Each BFV, M1 and Helicopter can use automation, but automation is of marginal value in other vehicles. LTC Jim Harris, a battalion commander who participated in the TF AWE, observed the effect of over digitization.

> Information dominance…There does not need to be a DSS for every soldier to have the full capabilities DSS provided for us at NTC. Our experience showed that the platoon leader should be the lowest level where the system should be employed, for he

> would get the FRAGO with graphics to execute a mission…The dismounted soldier should only have a voice commo package and positioning devise.[28]

Reducing the quantity of digitization equipment, perhaps as much as 50 percent would still provide units with adequate situational awareness. For example, the 404th Support Battalion had approximately ten percent of the FBCB2 systems other TFAWE units were assigned, but performed well. The battalion managed to maintain digital awareness without significant problems. Several benefits can be obtained by reducing the distribution plan for the digital systems. First, the time devoted to training for use of digital technology would be reduced, permitting more training on fundamental combat missions. Fewer digital systems would mean less congestion on the tactical Internet. With fewer systems, bandwidth would be saved. Additionally, power generation equipment, batteries, and other cost savings would be reduced.

Another unintended consequence of digitization may be loss of direct control of units during operations. The Paladin Field Artillery system digitally links field artillery guns together to support missions. The Paladin system allows a battery to engage a single target while the guns remain dispersed. This is a superb survival technique, but it presents several new challenges. The logistics packages supporting the battery must be sent to multiple delivery sites or the gun section must move to get their logistics. Moving a Paladin Battery on the battlefield demands decentralization. The digital solution is to issue movement graphics that establish boundaries for the movement of the guns and let individual leaders plan their routes. [29] The Paladin artillery lieutenants will have to shoulder more responsibility. This example illustrates an unintended, but successful application of ABCS technology. Without the digital information systems, the Paladin System would be much less survivable. Specifically, MCS capabilities that provide for the

digital mapping of routes, obstacles, and hazards all combine to give commanders the information they need to execute the decentralized missions. The MCS ability to provide continuous logistics updates contribute to reduced logistics in both forward artillery units as well as logistical units in the rear area.

In writing about the implications of the digital force, military author LTC Tim Thomas highlights three emerging problems of the information age for the Army's FXXI efforts.

> 1. The inability of analysts and equipment to visualize the *intent* of electronic images often causes on inaccurate operator "perception-reaction" response.
> 2. A dangerous game of digital roulette results from the inability of software's embedded scenarios to handle all of the anomalies and asymmetric options that develop, by design or otherwise.
> 3. The impact of electronic input can overwhelm the human dimension of decision making. [30]

Thomas uses the example of the Iranian civilian airliner shot down by the USS Vincennes on 3 July 1988 to explain the problem. He noted that,

> ".. the US, and by extension other countries using high-tech weapons, may have become prisoners of a technology so speedy and complex that it forces the fallible humans who run it into snap decisions that can turn into disaster." [31]

Software code written by different people with different backgrounds increases the potential for misunderstanding. The analyst's and programmer's training, expectations and frame of reference all leave them unprepared to interpret the virtual space.[32] The issue of software code writers from different cultures represents a potential shortfall in the development of the ABCS. Very few of the technical programmers and analysts have experience in military operations. With no frame of reference for the soldiers conducting operations using the ABCS technology, programmers will make mistakes. The extensive operational testing of the ABCS technology

using soldiers in simulated combat operations seeks to lessen this potential problem. ABCS will operate in a complex military environment and have more application at the higher levels of command and control. Complexity increases with each level of command.

If the FXXI systems are to support the cognitive needs of the 21st Century commander, is the physical size of the digital headquarters must be examined. With more reliance on technology and information systems, command systems become more vulnerable to attack. The electronic signature of FXXI equipped brigade and higher level command posts has increased, making these headquarters easier to detect, thus vulnerable to enemy attack.

As the Army develops the ABCS, success must be measured by viewing improvements through the eyes of the commander. The inability of automation to recognize limitations or illogical answers is important. FXXI automation equipment has no cognition. Developmental considerations for potential for illogical answers, vulnerabilities and poor design are important to ensuring the future commander gets the benefits of technology with the fewest costs.

FXXI technology helps the commander to get inside the decision cycle of the enemy. To do this accurate and rapid information about the enemy, terrain and friendly forces is required. Commanders seek to operate faster than any potential enemy, but to do this, the FXXI developers need to analyze how important timing is to the commander. Beyond the dogma that "faster is better" little is written on the concept. If FXXI technology improves decision making by rapid and accurate information, an understanding of timing and human cognition in battlefield conditions is necessary. Captain Robert Bateman's work provides some insight into this issue.

Captain Robert Bateman wrote about the Boyd Cycle and described the OODA loop process. In the late 1970's Colonel John Boyd coined the term OODA to denote a process to observe, orient, decide and act.[33] Boyd asked, "why did United States fighter pilots consistently win aerial combat engagements against enemy aircraft with better maneuverability." These observations led to the Boyd Cycle, a concept well known in the United States Air Force as the OODA loop. Bateman describes the OODA loop process below:

1. **Observe**: Our pilots could see the enemy better and more completely due to the cockpit design of our aircraft, which had great visibility.
2. **Orient**: Since our pilots saw the enemy first, they could react, or orient themselves towards the enemy faster.
3. **Decide**: After seeing the instinctually reacting with an initial orientation, our pilots' level of training allowed them to decide faster on their next combat maneuver.
4. **Act**: When US pilots input control movements to their aircraft, their inputs were more rapidly converted into control surface movements, with the resultant faster initiation of desired maneuver.[34]

The OODA loop as it became known, described how with inferior aircraft, USAF pilots consistently beat enemy pilots in aerial combat engagements. In Bateman's article, the Boyd Cycle, originally designed for aircraft, is applied to a ground force with a critical view towards timing and decision making. Bateman's article also explains how digitization contributes to the decision-making process. The OODA loop is a simplification of command and control and the decision making process. OODA provides a simplified conceptual model of decision making in aerial combat. While OODA provides a framework for understanding decision-making and C2 in ground military operations, it has more utility too, for describing ground tactical operations.

Bateman presents a decision-making model for ground military operations that he calls the RUDE loop. Bateman coined an acronym to describe ground organization decision making

and command/control system. RUDE refers to receive, understand, disseminate and execute (RUDE) cycle. [35] A detailed explanation of the RUDE cycle is contained at Appendix 2. Bateman pointed out that the "act" is not an instantaneous event for any Army unit. He explained how his RUDE cycle can answer two questions, "How do Army units move from decide to action" and "Where in this cycle might Force XXI and its attendant initiatives, have the greatest impact?" Bateman offers a cycle, similar to Boyd's OODA loop, applicable to ground combat organizations. Key to Bateman's discussion of the RUDE cycle is the significant opportunity to understand and disseminate the common operating picture both vertically and horizontally throughout the chain of command. FXXI automation processes enhance decision making described by Bateman's RUDE concept.

MCS provides the planning tool, orders preparation capability and terrain analysis support in one automated system that facilitates the vertical and horizontal distribution of the common operational picture. MCS already provides planning and decision-making tools to make the MDMP more adaptive. MCS facilitates the continuous and parallel planning ability to reduce the decision cycle. The common operational picture allows the commanders and staffs to make decisions that mesh with the decisions of other commanders in the network. The commander needs the capability to move from the decide phase of the model to the act phase, noted in Bateman's RUDE cycle above. MCS and FXXI digitization rapidly and accurately provide this capability. Bateman's RUDE cycle decision-making model better fits decision making than the MDMP. The RUDE model recognizes human cognition and accurately explains how decisions can be improved. RUDE also accounts for the adaptive decision-making needs that FXXI technology and the ABCS brings to the commander.

Chapter 2, Historical Perspective of the MDMP

The Army has used the MDMP to guide decision making and by extension, the MDMP is tied to the current staff organization for land combat. The MDMP is the Army's formal decision making process. Understanding the history of the MDMP helps to explain how FXXI automation supports the commanders cognitive decision making needs. The earliest reference to the MDMP is found in the1910 Army Field Service Regulation. The 1910 FSR explains the estimate of the situation process that has been an essential part of the MDMP since. The regulation states:

> An estimate of the situation involves a very careful consideration from the commander's viewpoint, of all the circumstances affecting the problem. In making this estimate he considers his mission as set forth in the orders or instructions under which he is acting, or as deduced by him from his knowledge of the situation, all available information of the enemy strength (strength, position, movements, probable intents, etc.), conditions affecting his own command (strength, position, supporting troops, etc.) and the terrain insofar as it affects the particular military situation. He then compares the various plans of action open to him and decides on the one that will best enable him to accomplish his mission.[36]

In this 1910 regulation, we find some significant problem-solving elements that have stood the test of time. The current MDMP still contains the analysis of the higher mission, enemy and friendly analysis and consideration of the terrain, course of action development and selection. However, feedback as a doctrinal approach, modification of the plan and the creative spark to develop COA's are all missing from this early version. The creative spark or idea for course of action formation is not in this early version, nor is if found in current MDMP doctrine. The creation of strategy or a plan is a vital element of the MDMP, arguably the most important. It is

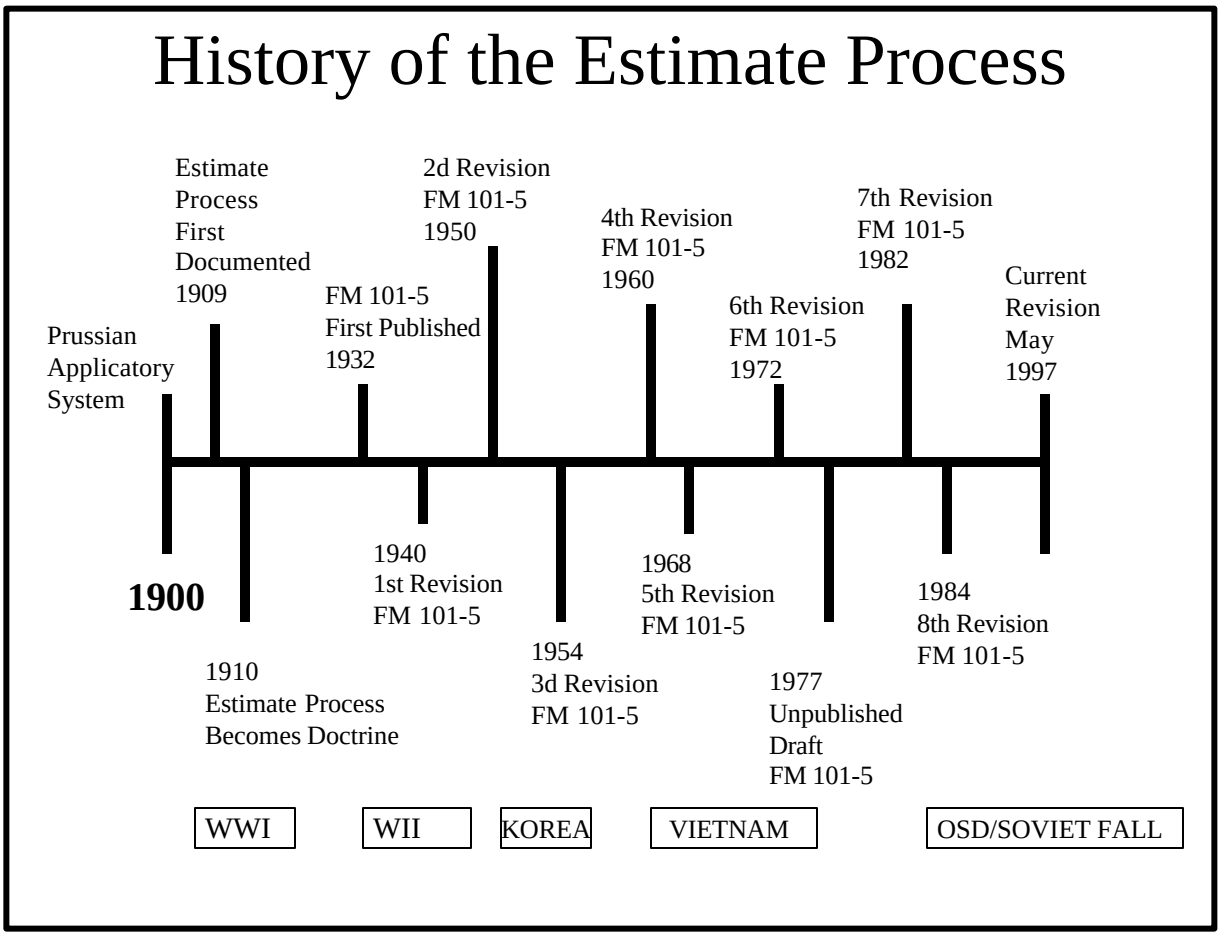
essential to look at this creation of a plan to answer the monograph question; "Does FXXI technology support the cognitive requirements of 21st Century tactical decision making?"

The MDMP was first described in the 1932 version of FM 101-5. Called the "Estimate of the Situation", this follow-on version of the 1910 FSR contained the following paragraphs:

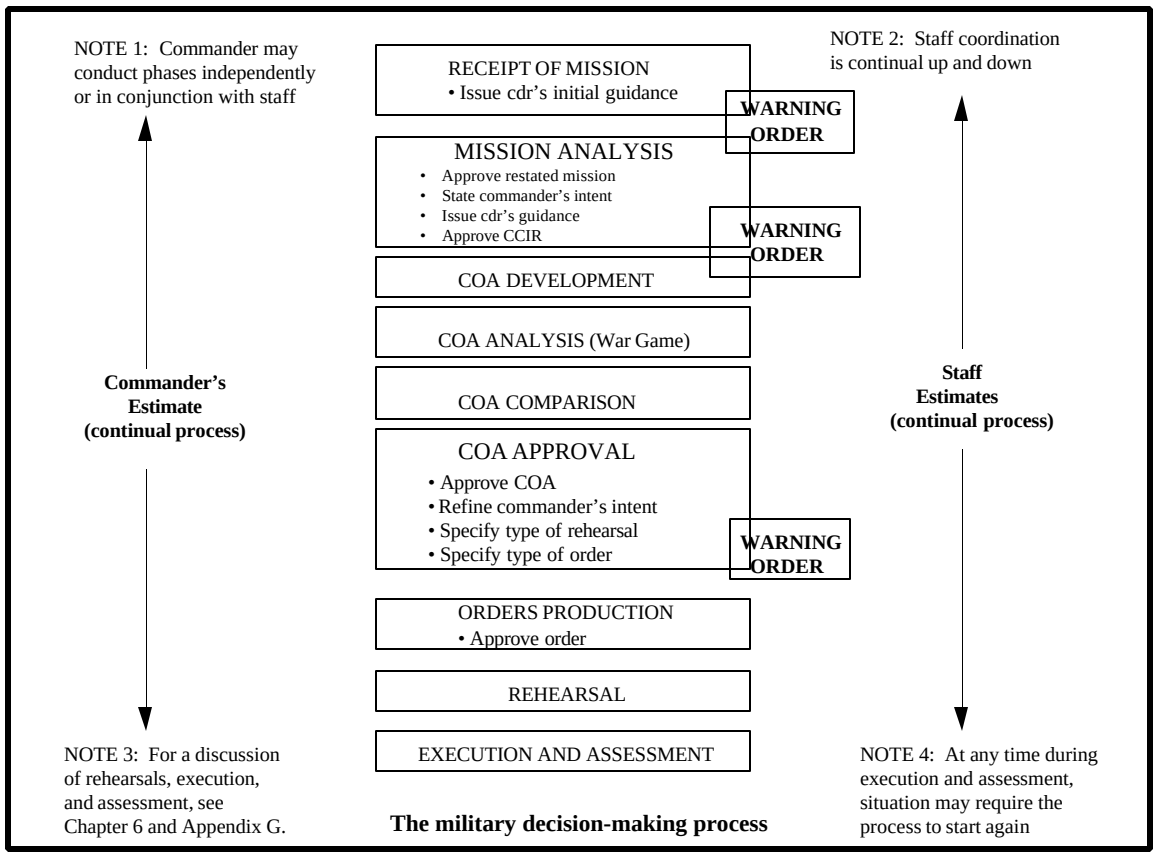
1. **Mission:** that mission assigned by higher headquarters
2. **Opposing Forces:** the disposition and relative combat strength of the enemy
3. **Enemy Situation:** analysis of the enemy's probably intentions
4. **Own Situation:** analysis of the available friendly courses of action
5. **Decision:** States what is to be accomplished, when, where and why [37]

The process today has changed little from the 1932 version. One change however, did occur in the 1940 version of FM 101-5. That version recognized that the decision making process is continuous and more importantly, that the estimate be as detailed as time allowed. [38] The formal consideration of time available is a critical break through. In the future consideration of time would lead to feedback and several abbreviated decision-making tools.

There have been thirteen revisions to the US Army's decision-making process. The first systematic attempt to describe the decision making process occurred in 1910. The figure below shows the evolution of the estimate process provides a historical background of the MDMP.[39]



The fact the process has stood for almost a century with some minor and few major modifications validate the MDMP and "estimate of the situation" concept. The figure below illustrates the Military Decision Making Process taken from the Army's current doctrine (FM 101-5, dated 31 May 1997).[40]



The military decision-making process

This figure illustrates the current MDMP. With minor variations, it has remained unchanged since before WW II. Still, nothing in the process or in the text of FM 101-5 explains how to create plan or course of action. To get to this problem, it is important to consider decision making from the view of the business and educators.

Decision Making in Business and Education

There have been volumes written on decision making in the military and the corporate world. Most authors, scholars and academics, however, are after the same goal that the MDMP seeks, the right decision that creates better outcomes. Three widespread accepted decision-making systems are applicable. Classical decision analysis (rational expectation or rational choice), satisficing (one option) and recognition-primed decision model (adaptive) will be reviewed.

The Classical Decision-Making Approach

The MDMP has its roots in the classical decision-making system. This system of decision making is probably the most commonly studied in the world today. Used in business, education, politics, economics and the military it is simple to follow and make logical sense. Gary Klein identified the five steps of the process:

1. Identify the set of options.
2. Identify the ways of evaluating these options.
3. Weighs each evaluation dimension.
4. Does the rating.
5. Picks the option with the highest score.[41]

The process is similar to the MDMP. Variants of the classic approach to decision making explore the feedback loop. The classical decision-making approach contains several shortfalls. First, like the MDMP, the classical decision-making approach mandates several options. If the staff picks only three options, how does the commander know these are best three options? Second, how can the commander know the unintended results of the options? The second and third order effects of various options are usually unknown.[42] Third is the probability that assumptions will be unnecessarily restrictive. Finally, bad decisions result from an analysis when performed before the actual decision. People tend to change the decision criteria to fit their pre-conceived notion of a right choice. Jim Shanteau found these same results in his 1988 study.[43]

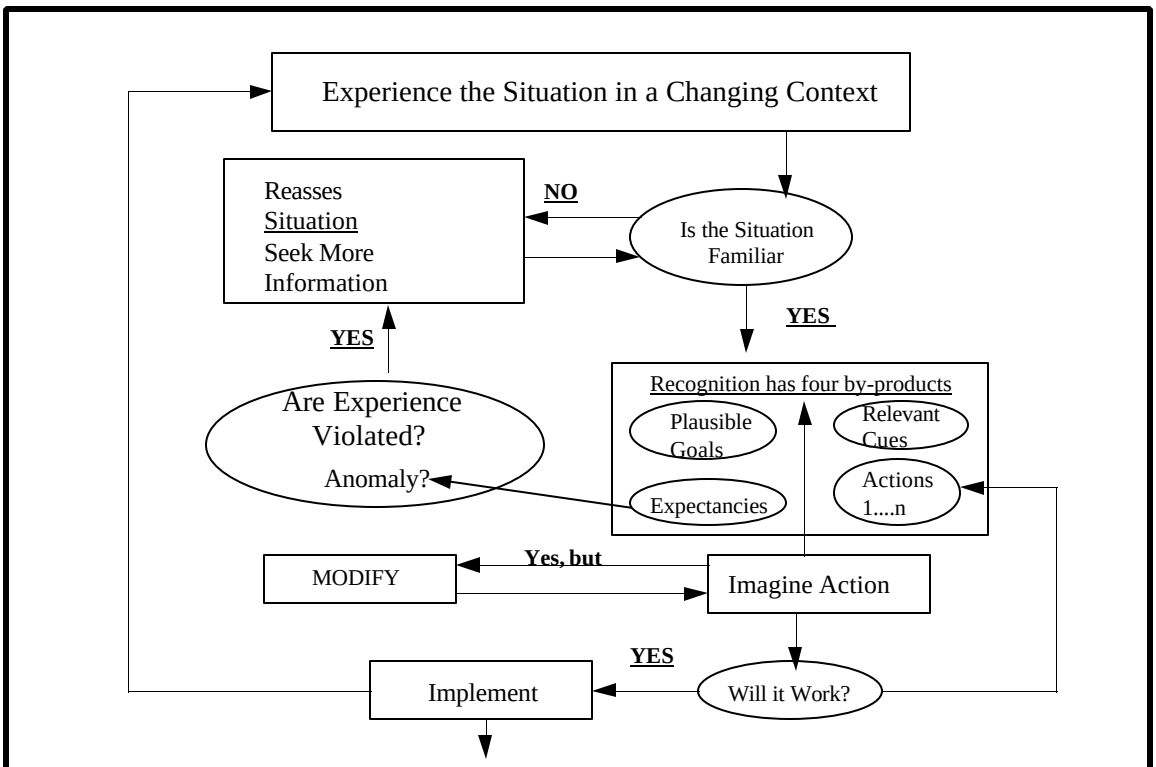
Satisficing

The second theory of decision-making relates to the initial research conducted by Herbert Simon, 1957 Nobel Prize winner in the field of Economics. Mr. Simon described a

decision-making strategy called satisficing: selecting the first option that works.[44] With clear application for the military leader, satisficing recognizes the value of time. Rather than spend time, money and effort seeking the "best" alternative, decision makers often select the first option that accomplishes the mission. Kline writes, "Because optimizing is hard work and takes a long time, satisficing is more efficient."[45] Satisficing is referred to as the singular evaluation or one option strategy. Decision-makers and leaders will often use a variation of this decision- making strategy because their first plan does not work. Then they will rapidly change to another option, not to find the best, but the first option that will work.

The Recognition-Primed Decision Model

The final decision making model discussed is the most complex and useful for this study. The recognition-primed decision (RPD) model combines two distinctive processes. First, the decision maker sizes up the situation to recognize which option or course of actions makes sense. Second, the decision maker, in our case the commander, imagines how the decision will play out in the future.[46]



Recognition Primed Decision (RPD) Model[23]

To explain this model, leaders first experience a change in environment. The change puts them in a new situation requiring a decision. Next, although the new situation is unique and new, leaders recognize the situation as familiar. Familiarity with similar situations permits the leader/decision maker to select goals that make sense and to establish priorities towards achieving these goals. In military situation, this means the commander issues guidance early in the decision-making process. Next, the leader decides which cues are important. Understanding the cues is valuable. These cues are important because the amount of data, information, knowledge and understanding all contribute to Situational Awareness (SA). Next, the decision maker forms his expectations. He will expect certain things to happen and other things not to happen. This helps both the decision maker and his staff to prepare and develop

expectations. In military terms, these expectations are the Commander's Critical Information Requirements (CCIR). In business, expectations might result in directions to subordinate staff sections look closely at what the competition, economy and/or government is doing concerning their particular product(s) or service(s). The decision maker may immediately know which goals are plausible because he recognizes the situation. Because the decision maker is in a familiar situation, the goals, cues, expectations and actions (courses of action) all point toward a likely solution.[47]

When a decision maker recognizes the situation, he rarely follows a detailed sequential process. This process was decomposed and resented sequentially to make it easier to understand. The process could have started the process backwards and still covered all the important points. Because of necessity and the uniqueness of every situation, the model has numerous variations.

Finally, the key to the RPD is the recognition of the problem. The cues, potential solutions and expectancies all help to understanding the problem. The expertise and experience of the decision-maker determines every solution, but not every potential solution. The RPD best reflects the system of decision making in the military and business. Scholars estimate that over 80 per cent of all decisions fit into this category.[48] The RDP decision-making model is a guide for digitizing the MDMP. While the Army doctrinally uses the MDMP taken from the classical decision-making model, leaders actually make decisions based on the RPD model.

What these decision making models suggest is that the MDMP represents a formal decision process that guides staff analysis. However, actual decisions by commanders are better explained by Herbert Simon's satisficing model and the recognition primed model.

Hence, in the automated environment the staff organization that supported the formal analytical process may not be the best organization around which to build the automated data flows

Examples of better Decision Making

Lieutenant Colonel Greg Banner in 1997 contended that there is a way to modify the MDMP that will lead to designing better courses of action.[49] He proposed that instead of designing and comparing COAs, the staff should work to maximize the best COA. He correctly pointed out that there is no formal system for developing COAs. Once a staff develops COAs, there are numerous techniques to compare them. The problem is how does the commander know that his staff has identified the best COA. The commander cannot know with certainty. Under pressure or the stress of combat operations, this becomes problematic.

Banner suggests a method for finding the best possible COA. He proposes modification of the MDMP by breaking down the operation into its critical tasks and assigning these tasks a priority. In Banner's approach, the commander receives an early briefing before the staff invests time in developing courses of action. The commander adds options or components he wants the staff to consider. Next, the staff identifies the best options under each component. The MDMP steps one and two are unchanged. What is changed is its purpose. Banner focuses on asking questions that help formulate the COA decisions. These questions are:

What are the "critical" pieces?
Of these pieces, which are the most important?
Within each piece, what are the options?
The Commander picks options fitting decisions with others.
In the end, you have a plan with the best COA.

Banner's goal is to develop a system that leads to the best overall COA. With only one best solution, the quality of the handpicked COA is improved. Each critical step is optimal. This systemic approach also calls for matrix showing the major components and options of the plan that will be useful if the operation needs change. The concept of one best COA to accomplish the mission however, does not address a thinking and adaptive enemy.

A better approach requires a response to an adaptive enemy. The concepts of the RPD model are found in the NTC OPFOR's decision-point tactics. OPFOR decision point tactics are a superb example of adaptive planning. LTC Peter J. Palmer defined decision point tactics.

> The art and science of employing available means at a specific point in space and/or time where the commander anticipates making a decision concerning a specific friendly course of actions. This decision is directly associated with threat force activity (action/reaction) and/or the battlefield environment.[50]

In these OPFOR decision point tactics there can be seen a basis for transforming the MDMP to conform to Klein's RPD model. Cues about the enemy, expectations about friendly and enemy forces, plausible goals to defeat him and a series of logical action/reaction exist in decision-point tactics. A COA is adapted only when the opportunity for success becomes evident. This type of decision making places great emphasis on adaptive planning. The commander and his staff focus on key decision points that are tied to information about the enemy, terrain and friendly forces at particular points in time.

General George S. Patton correctly pointed out a quandary every commander faces. He said, "There is a right time to make every decision. Trying to select the right time is the most important factor for every decision. It is a mistake to make the decision too early, and it is a

mistake to make the decision too late."[51] In military operations, the value of information decreases with the passage of time and contributes to the *fog of war*. Time is a precious commodity that enemy and friendly commanders will attempt to exploit. Pressure to act under conditions of uncertainty often leads to bad decisions. The value of information is always temporal. The value of information is dependent upon the commander's abilities to visualize and complete a military operation before the enemy can react. This is how the commander puts his forces into an advantageous position. It is essential to plan for a thinking and adaptive enemy under the constraints of time. FXXI automation assists mission planning and execution under time constraints. As noted earlier the ABCS/MCS systems has the potential to revolutionize adaptive planning. ABCS/MCS aids the commander by providing accurate and instantaneous information.

In *The Rise and Fall of Strategic Planning*, Henry Mintzberg observed that in the academic world there are five operational definitions of planning.

> Planning is future thinking.
> Planning is controlling the future.
> Planning is decision making.
> Planning is integrated decision making.
> Planning is a formalized procedure to produce and articulated result, in the form of an integrated system of decision.[52]

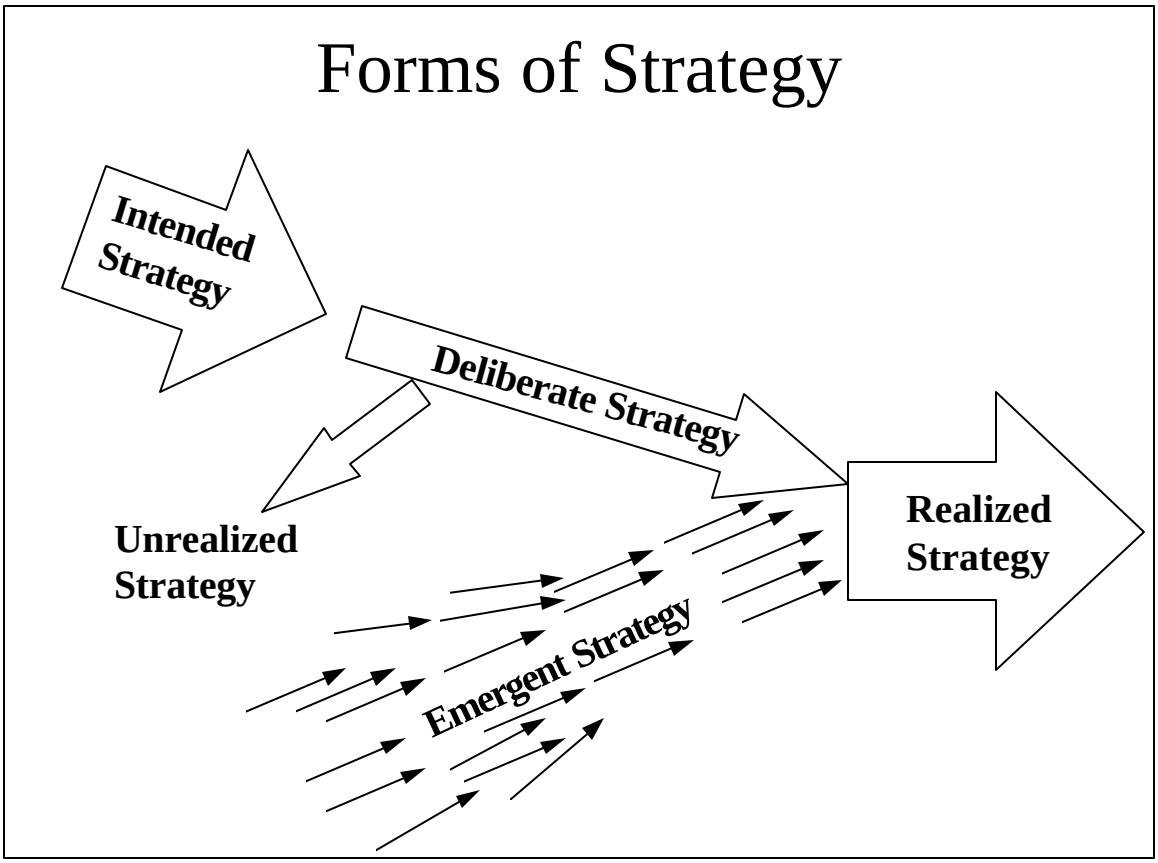
These definitions of planning and decision making are important because these notions are also held by the military. In asking why organizations should plan, Mintzberg developed with four reasons:

1. Organizations must plan to coordinate their activities.
2. Organizations must plan to ensure that the future is taken into account.
    a. Preparing for the inevitable

b. Preempting the undesirable
c. Controlling the controllable

3. Organizations must plan to be "rational."
4. Organizations must plan to control. [53]

Organizations plan for all these reasons, but the military assumption is that objectives are achieved by executing plans. Mintzberg asks the important question, "Must realized strategies always be intended?" Strategies modified or unfulfilled are unrealized strategies. However, objectives are often achieved by adjusting actions while executing a plan. The resultant path to the objective is different than the path conceived at the outset. This new path is what Mintzberg calls an emergent strategy.[54] Because FXXI technology provides a continuous stream of accurate data, the commander is able to assess whether he is on the path towards achieving the objective. If he is not, he can adjust the action of his forces to fit the circumstances. Thus, his strategy or plan is free to emerge.



Like business, few decisions in the military can be purely deliberate and few can be purely emergent. If the MDMP is deliberate planning, i.e., the current MDMP approach, then there is no adaptation or learning and high probability for failure. Likewise, if there is a plan for only emergent decision making, it infers no control. [55] Businesses plan their strategy with a proper mix of these different approaches. The best solution to a business problem is dependent on the details of the particular problem. In business organizations, this emergent strategy approach to planning and decision making is an umbrella strategy.

The Pfizer Corporation efforts in 1991 to develop heart-muscle relaxation medication are an example of adaptive decision making. The research and development efforts included over 1500 trails of new heart relaxation drugs. A side effect to one drug, Viagra included

increase in the sexual abilities of the participants at the trials. The company stumbled upon a new drug by accident as they completed their 1500 trials. By adapting, Pfizer Corp. capitalized on one of the most profitable drugs in history. Exceeding $ 1.0 billion in sales in 1999, the drug Viagra is one of Pfizer's most successful adaptations, though the research originally sought a heart medication.

Just as business organizations change and adapt to take advantage of opportunity, the Army can change the way it organizes to permit strategies to emerge. It is possible that the Army staff organization must be dramatically changed to take advantage of information technology.

Information Age Battle Staff

Enhancing information-age battle-command capabilities depends on improving commander and battle staff relationships and their collective ability to accomplish missions using the technological advances of the digitized environment.[56] It also requires efforts to enable plans to emerge and to permit commanders to recognize patters. Colonel Stephen F. Garrett has outlined a potential method for accomplishing this task. Rather than organize battle staff functions around the traditional functions of personnel, intelligence, operations and logistics, Garrett suggests the staff should be organized around situational awareness, synchronization and systems administration.

Garrett addresses the problem FXXI/Information Age commanders will face using the staff sections designed around classical staff procedures. To take full advantage of a reduced decision-making timeline and to decrease the battle staff rhythm, a staff needs the capability to

exploit fully the digital capabilities and to make rapid, parallel and simultaneous decisions. Garrett recommends three types of staff sections as opposed to the traditional approach.[57]

The *Situational Awareness Staff* section specializes in the common appreciation of information. The relevant common picture (RCP) as discussed earlier, is the digital tool that provides situational awareness. The situational awareness staff section would be organized to provide useful information for the commander to maintain a continuous, single battlespace common operating picture. The situation awareness staff would represents all the traditional battlefield operating systems (BOS). This staff section would track friendly, enemy and other critical information. Input from digital sources are key to this staff section but the situational awareness staff encompasses much more than the current intelligence section. The situational awareness staff section collects, analyzes and interprets information from all of the battlefield operating systems.

Even with common battlespace understanding, the commander must still be able to control action to act on his decisions. The *Synchronization Staff Section* solves this problem for the digital commander. Planning future operations separately from the interactive process is futile. Most planning is adaptive. If planning does not consider a changing, adaptive environment and enemy, subsequent operations are doomed to failure. Garrett notes that commanders are planning future operations as they act on what they see unfolding throughout the virtual battlespace.[58] The intuitive planning process results because human commanders are thinking, changing and adaptive. Digital systems make it possible to link the commander's decisions to adapt execution to the actions of his command. The synchronization staff section

purpose is to receive his new guidance and then plan the anticipated actions to ensure the required tasks are anticipated and communicated to subordinates.

Future design of the ABCS should continue enhance the adaptive decision making tools inherent in the MCS. The commander's intent is an important aspect of adaptive decision making. By getting the commander's intent early, staff sections are able to focus their efforts towards the course of action that the commander is most likely to approve. Garrett predicts that the commander's intent will become even more critical in fighting the digitized force. Because the commander's intent is important to future operations, a close link between future and current operations is essential. Garrett coins the term *dynamic synchronization* that melds current and future operations with planning functions that will make the synchronization staff section the operational arm of the staff. Dynamic synchronization is not a new concept and is described in business management science as the recognition primed decision-making model.

The *Systems Administration Staff* (SAS) section functionally ensures commanders receive and disseminate decision information without interruption.[59] The SAS section includes the ABCS workers who ensure that communications are timely, staff actions are accurate and parallel at different levels and that the force can act/react more skillfully than the enemy. This staff would be responsible for "ensuring continuous ABCS functionality including specific BOS connectivity and integration and the protections of systems from countermeasures and corruption of data input or databases." [60]

CHAPTER III, Conclusion

The Army's approach to decision making recognizes and accepts that military operations are uncertain. In dealing with uncertainty there can be two responses, either pursue certainty or cope with uncertainty. The FXXI process deals with pursuing certainty though technology that enhances awareness. Situational awareness is based knowledge of the environment, enemy/friendly forces and their activities. Reduction of uncertainty in turn, reduces risk, increases confidence and provides a temporal advantage over the enemy. This advantage applied over the BOS functions contributes to force protection, opportunity and victory. Situational awareness, knowledge based warfare and digital technology is converting the Army from its traditional orientation towards geography and sequential operations to a broader concept of battlespace and distributed operations. In this battlespace characterized by distributed operations, it is critical that commanders maintain situational awareness. The FXXI concept recognizes this and the Army is pursuing this goal. The development, testing and Advanced Warfighting Experiments demonstrate technology is successfully providing the commander with situational awareness to provide a decided advantage on the battlefield.

There are problems associated with the adoption of information technology into the MDMP. These shortfalls represent failure to consider the broad range of factors affecting the digitization process. The study suggests the Army should continue with the FXXI digitization process but place emphasis on improving the MDMP. Specifically, rather than automating a manual MDMP process, the Army needs a systematic approach to decision making that considers all the DTLOMS elements.

Appendix 1: RUDE **CYCLE** [61]

CPT Robert L. Bateman III

Receive. The physical process of acquiring the OPORD or FRAGO from a higher headquarters. Traditionally accomplished in person (messenger), by voice with accompanying graphics. This almost always meant by person or vehicle which takes some amount of time (greater than zero. This movement if verbal takes less but if written can take significant time. With the advancements in digital technology it is possible to transmit shared graphics, digital photos, multiple addressee texts and conduct video/audio conferencing.

Understand. "A picture paints a thousand words" and visual aids are fast and efficient in imparting complex concepts to others. With computer and digital transmission, our gourd forces have acquired the potential to use this second sense (sight) to supplant the traditional method of remote transmission (hearing). Key however is the subordinate must understand before he may disseminate information.

Disseminate. There is no step that refers to the MDMP because the process is adaptive with no start and no end. It is continuous between echelons, vertically and horizontally. It has become simultaneous and is executed in parallel to the RUDE loop. With our ABCS technology we can leap ahead of the enemy by completing our understanding and follow this up with immediate dissemination and execution.

Execute: Actual putting into motion the soldiers and their systems i.e., soldiers/vehicles moving, rounds down range, hot steel on target, etc. Note: The RUDE loop executed sequentially within each echelon may run several iterations before actual execution. [62]

APPENDIX 2

Maneuver Control System Capabilities. [63]

MCS Block III

Maps & Overlays

Provides automatic updates of friendly/enemy unit locations and Battlefield Geometry.
Tactical Overlay creation and editing features.
Terrain and mobility analysis and evaluation tools.
3-Dimensional Flight viewer

OPLAN / OPORD

Provides full OPLAN, OPORD and FRAGO production capabilities using MS Word.
HTML and USMTF formatting capability.
Capable of linking the UTO to an OPORD/OPLAN.

Unit Task Organization (UTO)

Provides a graphic/tabular view of unit org.
Modification of unit command relationships and task organizations.
A link as Annex A to OPORD.
Capability to transfer UTO to other MCS

Reports

Provides updates via CSSCS.
Provides graphic/tabular displays of resource info and combat resource strength.
Employs green, amber, red and black colors for standard resource levels.

Synchronization Matrix

Provides graphic display of unit missions as they relate in time.
Used to analyze course of action (COAs).

Messaging

Provides USMTF and VMF format capabilities.
Message autoposting, autofilling, autoforwarding and autosending capability available.
Provides multiple addressing and message editing.

C2 Products

Provides whiteboard interactive planning tool (SHOWME) for Commander/Staff to develop and “Wargame” mission.
Snapshot capability allows map screen backup with graphic tool to display/emphasize plans, ideas, and intent with audio and video.
Provides access to archive and system files.

Provides access to other system tools and utilities.

MCS Block IV

Internal Interfaces

- Provides access to other BFA's information using database information exchange.
- Provides information to the other applications to produce reports and map displays
- Integrates products into the CP, MO and PL applications.

Maps & Overlays

- Provides similar functionality resident in MCS Block III, but uses Joint Mapping Toolkit (JMTK) vs. TEM.
- Fulfills the mapping needs of planning and common picture applications
- Supports FM 25-25A map symbology
- Map is integrated with OPLAN/OPORD and execution matrix for alerts and system executions.

Planning

- Provides a graphic/tabular view of unit org.
- Modification of unit command relationships and task organizations.
- A link as Annex A to OPORD.
- Capability to transfer UTO to other MCS

Common Tactical Picture

The FDD marks a new era for the Army. The Army will use computer technology in the battlefield to obtain information dominance. The major piece of this computer technology is the Army Battle Command System (ABCS). An essential component of ABCS is the Maneuver Control System (MCS). MCS will provide the battlefield commander with a Common Operating Picture (COP). The COP is a relevant view of the battlefield. The key is that each Army information system should have the same view. The web site acts as a repository for information on and tools to assist in the development of the CTP.

Appendix 3: List of Abbreviations

ABCS	**Army Battle Command System**
ADO	**Army Digitization Office**
AMC	**Army Materiel Command**
ASAS	**All Source Systems Analysis**
AWE	**Advanced Warfighting Experiment**
BFA	**Battlefield Functional Area**
BFV	**Bradley Fighting Vehicle**
BOS	**Battlefield Operating System**
BSA	**Brigade Support Area**
C2	**Command and Control**
CCIR	**Commanders Critical Information Requirements**
CO	**Commanding Officer**
COA	**Course of Action**
COE	**Common Operating Environment**
COP	**Common Operating Picture**
CSSCS	**Combat Service Support Control System**
CTP	**Common Tactical Picture**
DA	**Department of the Army**
DCSOPS	**Deputy Chief of Staff for Operations**

DoD	**Department of Defense**
DSS	**Dismounted Soldier System**
DTLOMS	**Doctrine, Training, Leader Development, Organization, Materiel, and Soldier Systems**
FARRP	**Forward Area Rearming and Refue ling Point**
FDD	**First Digitized Division**
FBCB2	**Force XXI Battle Command Brigade and Below**
FM	**Field Manual**
FORSCOM	**Forces Command**
FSR	**Field Service Regulation**
FRAGO	**Fragmentary Order**
FXXI	**Force XXI**
ID	**Information Dominance**
IP	**Internet Protocol**
JV	**Joint Venture**
LD	**Line of Departure**
M1	**Model Number for the Abrams Tank**
MCS	**Maneuver Control System**
MECH	**Mechanized**
NCO	**Noncommissioned Officer**
NTC	**National Training Center**
ODS	**Operation Desert Storm**

ODSS	**Offense, Defense, Stability and Support**
OODA	**Observe, Orient, Decide, Act**
OPFOR	**Opposing Force(s)**
OPORD	**Operations Order**
OPTEC	**Operational Test and Evaluation Command**
OPTEMPO	**Operational Tempo**
PEO	**Program Executive Office**
RAP	**Rapid Acquisition Process**
RCP	**Relevant Common Picture**
RPD	**Recognition Prime Decision-Making**
RUDE	**Receive, Understand, Disseminate, Execute**
SA	**Situational Awareness**
SCIPS	**Standardized Integrated Command Post System**
SOP	**Standard Operating Procedures**
SPO	**Support Operations Officer**
TECOM	**Test and Evaluation Command**
TFAWE	**TaskForce, Advance Warfighting Experiment**
TOC	**Tactical Operations Center**
TRADOC	**Training and Doctrine Command**
UTO	**Unit Tasking Order**
WWII	**World War II**

Endnotes

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